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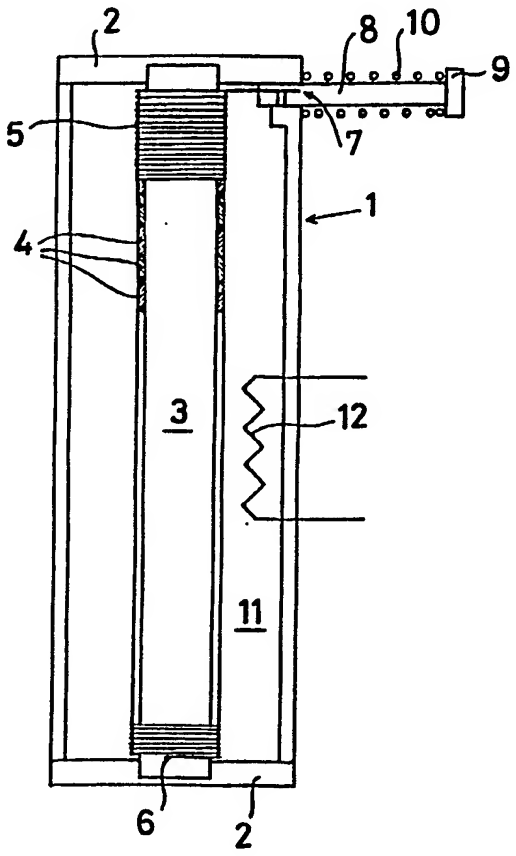
(54) Title: HEAT SENSITIVE MECHANICAL ADJUSTING APPARATUS

(57) Abstract

A heat sensitive mechanical adjusting apparatus comprising a wire (5) maintained pretensioned by a spring (10) is described, one end (6) thereof being fixedly connected to a casing (1) and the other end (7) being connected to an output element (8) the displacement of this output element (8) being a measure of the temperature of the wire. Furthermore an application of this apparatus is described for adjusting a tubular-lamp control circuit with economy operation of function of the ambient temperature.



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Heat sensitive mechanical adjusting apparatus.

The invention relates to a heat sensitive mechanical adjusting apparatus according to the preamble of claim 1.

Apparatuses of this kind are known, comprising, for instance, a bimetallic strip, with which, for instance, when exceeding a given temperature, a switching element can be operated. For obtaining an accurate displacement depending on the temperature, such apparatuses are not suitable.

It is an object of the invention to provide an apparatus by means of which adjustments depending on the temperature can be performed in a very accurate way, which apparatus has the characteristics of claim 1.

Favourable embodiments of this apparatus are defined in the subclaims.

The invention will be elucidated below by reference to a drawing, showing in:

Fig. 1 a schematic representation of an embodiment of the apparatus according to the invention;

Fig. 2 a cross-section of a modified part of this apparatus;

Fig. 3 a cross-section corresponding to Fig. 1 of an other embodiment of the apparatus according to the invention;

Fig. 4 a schematic representation of still an other embodiment of the apparatus according to the invention; and

Figs. 5 and 6 circuit diagrams of a tubular-lamp circuit in which an apparatus according to the invention is included.

The adjusting apparatus according to the invention shown in Fig. 1 comprises a cylindrical casing 1 with terminal plates 2. In the terminal plates 2 a core 3 is supported. On the core 3 sleeves 4 are provided which are mutually independently rotatable on the core 3. These sleeves are provided with helical grooves (not shown). A wire 5 is wound over the complete length of the core on the sleeves 4, the individual wire-turns lying in these grooves. One end of the wire 5 is, at 6, fixed on the core. The other end 7 is

connected with a pin 8 which partly extends outwardly from the casing. This pin has, at its outer end, a collar 9, and between this collar and the outer side of the casing 1 a compression spring 10 is arranged pressing the pin 8 outwards, so that the wire 5 is kept under tensile stress.

The internal space 11 of the casing 1 is filled with oil. Moreover, in this space 11 a heating resistor 12 can be provided allowing a control of the apparatus.

Variations of the ambient temperature are tranferred, by means of the casing 1 and the oil filling of the space 11, towards the wire 5, the latter then experiencing a corresponding length variation. Since the pin 8 is under tensile stress, and, therefore, keeps the wire 5 tensioned, this pin will more or less extend from the casing 1 depending on the extension or contraction of the wire 5. At a length of the wire 5 of 50 m, the displacement of the pin 8 will be some tens of mm. The wire 5 consists of a suitable metal or metal alloy with, preferably, a possibly large coefficient of extension, and having a strength which is sufficient for withstanding the tensile stresses occurring during use.

The pin 8 forms the output element of the device, and can be coupled with an element to be adjusted, e.g. a sliding resistor, so as to transduce a displacement of this pen 8 into a variation of an electrical quantity.

On extension or expansion of the wire 5, the wire turns will slip slightly over the sleeve 4 in question, this sleeve 4 then experiencing an average rotation. Because of the subdivision into sleeves, the relative movements will, however, remain small, and the oil will reduce the friction still further.

It is, as such, possible to use, instead of the sleeve 4, a non-divided core 3, but then the slip movements of the wire 5 will be larger accordingly. The core 3 can be rotatable too, provided that the fixation point 6 is fixed.

Instead of a cylindrical core 3 it is also possible, as shown in Fig. 2, to use a needle or rod cage 3', the needles or rods being directed parallel to the longitudinal axis. The contact surface between the wire 5 and the needles or rods 13

is, then, considerably smaller than in the case of a cylindrical core 3, and the oil has a better access to the contact surface, so that the friction will be smaller accordingly. In the case of round needles, these can be rotabably supported, and it is also possible to provide each needle with sleeves 4, so that the friction can be reduced still more.

In an embodiment corresponding to Fig. 1 and shown in Fig. 3, the core 3 is rotatably supported, which core is driven by means of a spiral spring 8' in the winding sense of the wire 5. This wire is, again, fixed at 6 to the core 3, and the other end is fixed to the casing 1 at 7'. At length variations of the wire, the core 3 is rotated, which rotation corresponds to the total length variation of the wire.

On the axis of the core 3 an output element, schematically shown at 9', is provided, which, again, can be coupled with an apparatus to be adjusted. This can, for instance, be a rotation resistor or the like, but can also consist of a plate provided with a grey wedge cooperating with a light source and a photocell, in order to obtain an electrical output corresponding to the rotation.

Also in this case the wire 5 will slip in respect of the core 3 the more as the distance to the fixation point 6 becomes larger. If desired also in this case the sleeve 4 can be provided, and the core 4 can also be constructed as a needle or rod cage according to Fig. 2.

Fig. 4 shows a schematical representation of still another embodiment. This comprises a plane plate 1' on which pins 13' are provided, and the wire 5 is guided, as shown, around the pins 13'. One extremity 6 is connected to the first pin, and the other extremity 7 is fixed to a shiftable pin 8 which, as shown in Fig. 1, is under spring tension. This extremity can also be led around a rotatable pulley and be fixed thereto, which pulley is pre-tensioned in the same manner as the core 3 of Fig. 3 by a spring in the winding sense of the wire. Above the pins 13' a second plate can be provided in order to avoid that the wire 5 will run off the pins. Moreover these plates can be completed to form a closed casing which, again, can be filled with oil or the like, and

wherein, if required, a heating resistor 12 can be provided.

Fig. 5 shows an example of application such an adjusting element indicated at 1. The circuit shown comprises a tubular lamp 14 with heating wires 15, a starter switch 16 and a series impedance 17. A control resistor 18 is included in series with the lamp 14, and serves to reduce the voltage over the lamp for obtaining an economy operation. This resistor 18 can be bridged by means of a switch 19 in order to put the full voltage on the lamp. This switch can be opened or closed by means of a control apparatus, for instance a timer.

In order to obtain an optimal economy, the voltage over the lamp 14 should be as low as possible during the economy period. If, however, the ambient temperature is low, the reduced voltage should be higher than at higher temperatures, since, otherwise, there is a risk that the voltage decreases below the operating voltage. An automatic control can be obtained by adjusting the resistor 12 by means of an apparatus 1 according to the invention, in order to ensure that always an economy voltage adapted to the ambient temperature is obtained. The control apparatus 20 can also be a circuit which is sensitive for the ambient light intensity, by means of which the light intensity of the lamp 14 can be adjusted in function of the ambient light intensity, the apparatus 11 ensuring again that a lower threshold related to the ambient temperature will not be passed in the downward sense.

In Fig. 6 a somewhat modified circuit is schematically shown. The resistor 18 is now divided into two partial resistors 18a en 18b connected in series, each being arranged near a terminal part of the tubular lamp 14. To that end both lamp fittings can be provided with suitable recesses or the like for accommodating these resistors. These partial resistors 18a and 18b can be directed in the longitudinal or the circumferential direction of the lamp fitting in question.

These resistors will, when during the economy periods heat is developed therein by the flowing current, transfer the heat to the vicinity of the lamp extremities, thus counteracting cooling thereof, and, thereby, the risk of extinguishing

the gas discharge. In order to enhance this effect, the tubular lamp 14 or at least its terminal parts can be, as schematically shown in Fig. 6, by means of a sleeve 21 of a suitable light-transmitting material, in particular plastics, which sleeve extends at some distance coaxially in respect of the lamp 14.

If both partial resistances 18a and 18b are connected in series, only one thereof should be made adjustable, in order to be adjusted by means of an adjusting element 1 according to Fig. 5 on a value which is adapted to the current intensity required for maintaining the discharge during the economy periods. The element 1 can be made very small, and can, again, be provided in a recess of a lamp fitting in order to measure the local temperature.

It is also possible to arrange an other part of the resistor 18 outside the lamp fitting or the sleeve 21, an adapted adjustment being required then in order to compensate the influence of the ambient temperature. If this element is arranged near a lamp fitting, the heating effect of the current and the insulation by the sleeve 21 can, of course, be included better into the measurement.

In general the heating element 12 of Fig. 1 can provide an additional security when the ambient temperature decreases too much. By means of the output element 8 or 8', this heating element can be switched on, as soon as a given lowest temperature has been reached, and then it can be provided that the oil temperature will not decrease further. This heating element 12 can be included into a feed-back circuit by means of which the operating point of the apparatus can be adjusted in connection with the desired control operation.

It will be clear that this apparatus can be used for many other purposes, and that, therein, many modifications can be made without leaving the scope of the protection.

Claims

1. Heat sensitive mechanical adjusting apparatus comprising an element, the length variation of which under the influence of the temperature is transferred to an output element, **characterized in that** this element is a wire (5) guided over wire guiding means (3, 4, 13, 13'), one end (6) of this wire (5) being fixedly connected to a carrier or casing (1, 1') the other end (7) being connected to the output element (8, 8') the latter being movable under the influence of the spring (10) in respect of the casing (1) thereby pre-stressing the wire (5).

2. The apparatus according to claim 1, **characterized in that** the casing (1) is closed, the interior thereof (11) being filled with a heat-transfer means such as oil.

3. The apparatus according to claim 1 or 2, **characterized in that** the wire guiding means comprise a cylindrical core (3), round which the wire (5) is wound in a single layer.

4. The apparatus according to any one of claims 1..3, **characterized in that** the output element (8) is a pin which is shiftable in respect of the carrier or the casing (1, 1').

5. The apparatus according to claim 3, **characterized in that** the core (3) is rotatably supported in the casing (1), and in that the output element (8') is connectd to this core (3).

6. The apparatus according to any one of claims 2..5, **characterized in that** the core is a cage (3') composed of needles or rods (13) directed parallel to the axes.

7. The apparatus according to any one of claims 1..6, **characterized in that** on the core (3) or the rods (13) sleeves (4) which are freely mutually rotatable, are provided.

8. The apparatus according to claim 1 or 2, **characterized in that** the carrier comprises at least one plate (1') on which an assembly of mutually parallel pins (13') are arranged.

9. The apparatus according to any one of claims 1..7, **characterized in that** in the core (3), the rods (13) or the

sleeves (4) wire accommodating grooves are provided.

10. The apparatus according to any one of claims 1..9, **characterized in that** in the interior space (11) of the casing (1) a heating resistor (12) is provided.

11. The apparatus according to any one of claims 1..10, **characterized in that** the wire (5) has a thickness of about 0,05..0,5 mm and a length of 20..50 m.

12. The apparatus according to any one of claims 1..11, **characterized in that** the output element (8, 8') is coupled with an electrical or electro-optical adjustment element.

13. An assembly for controlling a tubular lamp with, in particular, periodical reduction of the light emitted thereby, by means of a series element (18) connected in series with the lamp (14) in the circuit thereof, in particular a series resistor, the value of which can be adjusted so that the current through the lamp will be maintained just above the extinction value, which series element (18) is at least partially variable, and is coupled with an adjusting apparatus according to any one of claims 1..12 in order to be adjusted on the required value in correspondence with the temperature.

14. The assembly according to claim 13, **characterized in that** at least a part of a series element (18) is arranged near or in a lamp fitting of the lamp (14).

15. The assembly according to claim 14, **characterized in that** the lamp (14), at least at the series element (18) is surrounded by an insulating sleeve (21).

16. The assembly according to claim 14 or 15, **characterized in that** the adjusting apparatus (1) is also arranged near or in a lamp fitting or within the sleeve (21).

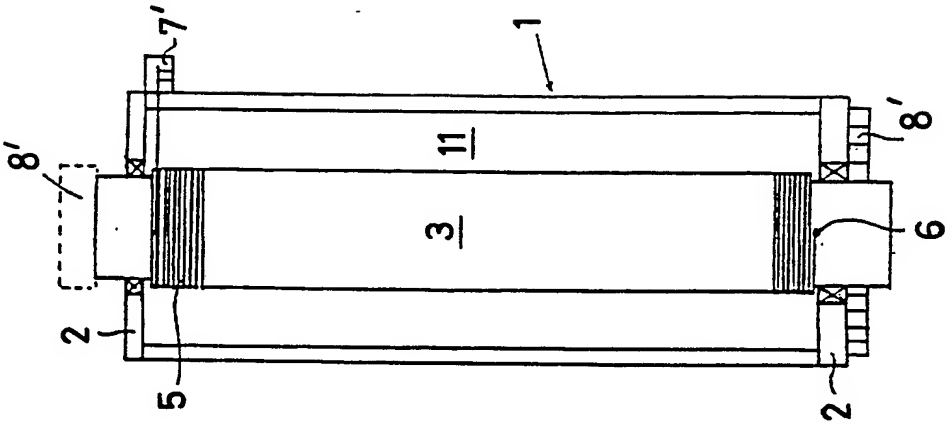

FIG. 3

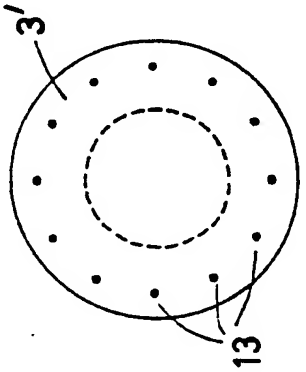

FIG. 2

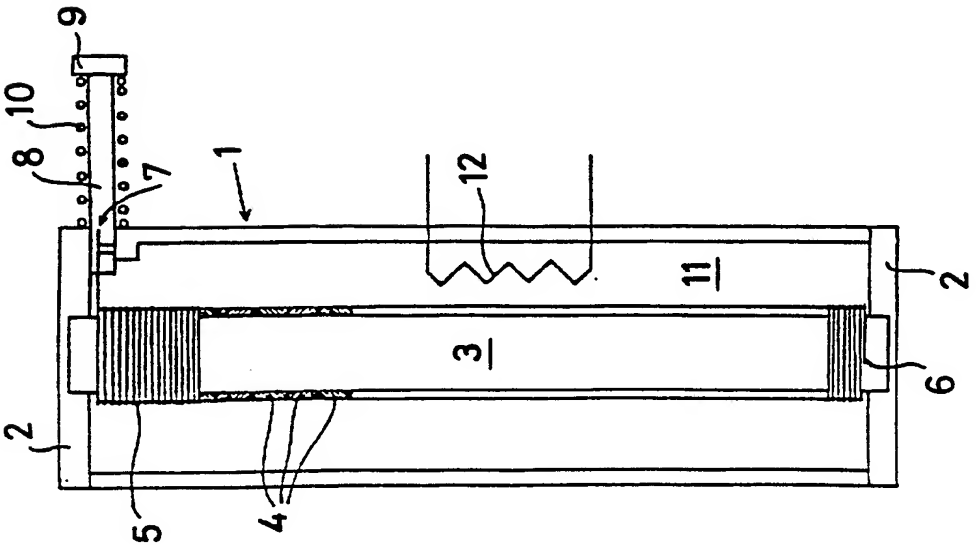

FIG. 1

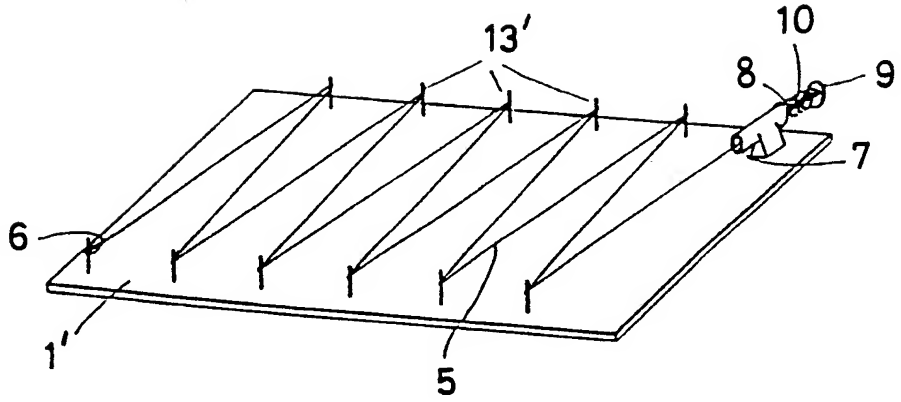

FIG. 4

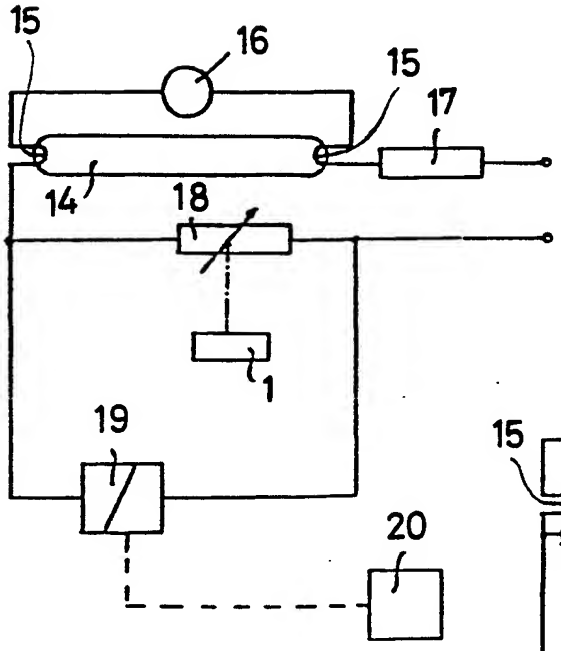

FIG. 5

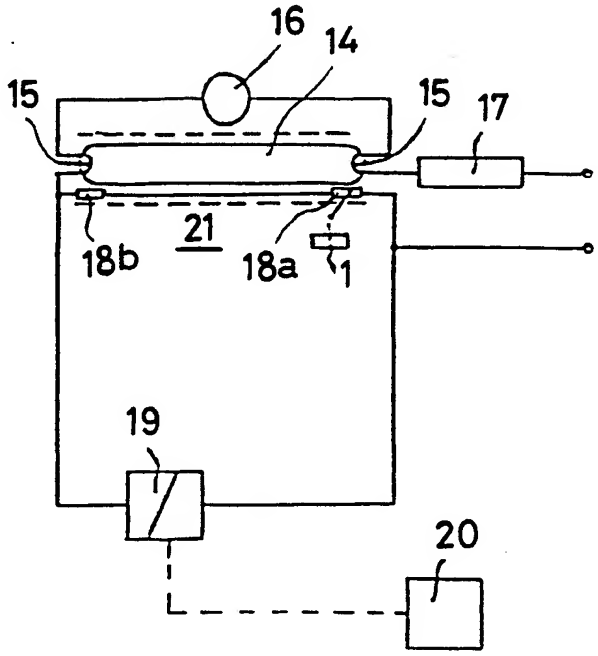

FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/NL 91/00157

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 G12B1/00; H05B41/392; H01H37/50; H05B1/02

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	G12B ; H05B ; H01H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X A	US,A,3 809 862 (SIMMONS) 7 May 1974 see column 3, line 43 - column 4, line 37; figures 3,6,7	1,3,4,12 5
X	WO,A,9 005 992 (MUESSLI) 31 May 1990 see abstract; figures 1,3-5	13,14,16

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
27 FEBRUARY 1992	04 MAR 1992
International Searching Authority	**Signature of Authorized Officer**
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. NL 9100157 SA 50317

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 27/02/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-3809862	07-05-74	US-A- 3737826	05-06-73
WO-A-9005992	31-05-90	CH-A- 677571	31-05-91
		AU-A- 4514689	12-06-90
		EP-A- 0412130	13-02-91
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